Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Parts 74, 78, 101 of the	)	
Commission's Rules to Adopt More	)	ET Docket No. 96-35
Flexible Standards for Directional	)	
Microwave Antennas	)	

REPORT AND ORDER

Adopted: January 2, 1997 **Released: January 17, 1997**

By the Commission:

INTRODUCTION

1. By this action, we amend the performance standards for directional antennas employed under Parts 74, 78, and 101 of the Commission's Rules in order to permit the use of new antenna technology. Specifically, the rule amendments that we adopt today will allow licensees to show compliance with the Commission's Rules for antenna standards using either minimum antenna gain or maximum radiation beamwidth. This action removes an implicit prohibition in the Commission's Rules against new types of antennas which have narrow beamwidths, but insufficient gains. This action also will encourage innovation in antenna technology and will give licensees more options in the types of antennas they may employ, without decreasing spectrum efficiency or increasing interference.

BACKGROUND

2. In order to maximize spectrum efficiency and minimize interference, the Commission's Rules for fixed microwave antennas specify various technical requirements designed to control the radiation pattern of directional antenna emissions.[1] The intent of these rules is to limit the width of the main beam (or beamwidth) of point-to-point links, thus allowing more point-to-point

[1] These rules are codified at Sections 74.536, 74.641, 78.105, and 101.115 of the Commission's Rules. *See* 47 C.F.R. §§ 74.536, 74.641, 78.105, and 101.115.

use of the same spectrum in a given area.[2] For many frequency bands, our rules indirectly limit beamwidth by specifying mandatory minimum acceptable antenna gain requirements.

3. A directional antenna focuses radio power into a narrower beam than does an omnidirectional antenna.[3] This focusing limits the radiation of power in unintended directions and thus facilitates frequency reuse. Such directionalization results in a higher Equivalent Isotropically Radiated Power ("EIRP") in the direction of focus of the antenna than is provided in any direction by an omnidirectional antenna operating with similar input power.[4] The EIRP in other directions is smaller for directional antennas than for omnidirectional antennas of similar input power. One way to measure the directionality of an antenna is to measure the beamwidth of the radiated power directly. However, this direct measurement is technically difficult to perform. An easier measurement is the antenna gain, *i.e.*, the strength of the radiated power in the center of the beam.[5] In conventional antennas, these two parameters are correlated: high antenna gain is always paired with narrow beamwidth antenna designs,[6] so that the gain can be mathematically derived from the beamwidth and *vice versa*.[7]

4. Recent technological developments have made alternative directional antenna designs available. One of these technologies, planar arrays, spreads the power over a large number of radiating elements in a flat plane in order to achieve a narrow beamwidth. Such antennas must split the input power several times in order to feed it to the multiple radiating elements. This

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[2] The region of maximum radiation between the first null points around the radiation pattern displayed in polar coordinates is the main beam and the regions of minor maxima are sidelobes. The main-beam beamwidth describes the sharpness of the main radiation region. It is generally taken to be the angular width of a pattern between the half-power, or -3 decibels ("dB"), points. *See Field and Wave Electromagnetics*, by David K. Cheng, at 507-512.

[3] An omnidirectional, or nondirectional, antenna has an essentially circular radiation pattern in azimuth and a directional pattern in elevation. An omnidirectional antenna radiates and receives equally well in all directions. *See McGraw-Hill Electronics Dictionary*, Fifth Edition, John Markus and Neil Sclater, at 370.

[4] EIRP is defined as the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna. *See* 47 C.F.R. § 2.1. An isotropic antenna or unipole is a hypothetical antenna that radiates or receives signals equally well in all directions. *See McGraw-Hill Electronics Dictionary*, Fifth Edition, John Markus and Neil Sclater, at 564.

[5] The power gain, or simply the gain, of an antenna referenced to an isotropic source is the ratio of its maximum radiation intensity to the radiation intensity of a lossless isotropic source with the same power input. The gain of an antenna is thus a measure of antenna efficiency.

[6] Horn and dish antennas are the most common types of traditional directional antennas.

[7] In converting antenna gain to beamwidth, we assume that the antenna is a circular dish (thus the beam is circular symmetric), that the antenna efficiency is 55% (typical for a dish antenna), and that the antenna sidelobes are down more than 20 dB (approximately a 10 dB illumination function taper). Based on these assumptions, a minimum antenna gain of 34 dBi is equivalent to a maximum beamwidth of 3.5°, 36 dBi is equivalent to 2.7°, and 38 dBi is equivalent to 2.2°.

multiple power splitting results in inevitable power losses which, in turn, limit the achievable antenna gain.[8] Thus, while such directional antennas can achieve sufficiently narrow beamwidths to comply with the intent of our rules, they cannot comply with the present rule, which literally requires a specific minimum antenna gain. These technical developments prompted us to initiate this proceeding.

5. On February 29, 1996, we adopted a *Notice of Proposed Rule Making* ("*NPRM*") in this proceeding.[9] In the *NPRM*, we proposed to permit licensees to make a showing that the antennas employed under Parts 74, 78, and 101 meet minimum antenna performance standards through the use of maximum beamwidth requirements as an alternative to minimum antenna gain requirements. In addition, we proposed to treat all antennas as if they had the mainlobe shape and gain of a conventional parabolic dish antenna. In response to the *NPRM*, twelve comments and three reply comments were filed.[10]

DISCUSSION

6. The parties generally support the basic proposal in the *NPRM*, that is, to allow users to show compliance with the minimum antenna performance standards using either maximum beamwidth or minimum gain.[11] For example, Comsearch states that spectrum efficiency depends upon antenna radiation pattern performance (beamwidth, sidelobe suppression, and front-to-back ratio), not upon antenna gain, and that thus, there is no need for a minimum antenna gain requirement as long as the maximum beamwidth and minimum radiation suppression requirements are met.[12] Endgate Corporation ("Endgate") agrees that the adoption of this proposal would remove a regulatory impediment to the use of new antenna technology and further states that such

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[8] While this explanation deals with transmitting antennas, receiving antennas have similar losses which limit the achievable gain.

[9] *See* 11 FCC Rcd 12360 (1996).

[10] The commenting parties are: Alcatel Network Systems, Inc. ("Alcatel"), Andrew Corporation ("Andrew"), Commco, L.L.C. ("Commco"), Comsearch, Digital Microwave Corporation ("Digital Microwave"), Endgate Corporation ("Endgate"), INNOVA Corporation ("INNOVA"), National Spectrum Managers Association ("NSMA"), Society of Broadcast Engineers, Inc. ("SBE"), Fixed Point-to-Point Communications Section, Network Equipment Division of the Telecommunications Industry Association ("TIA"), and 360° Communications Company ("360° Communications"). Ericsson Inc. ("Ericsson") filed its written *ex parte* comments late. We believe it to be in the public interest that Ericsson's comments be considered in this proceeding and we hereby accept them. The reply commenting parties are: Comsearch, NSMA, and TIA.

[11] *See* Comments of Alcatel at 2, Commco at 1, Comsearch at 3, Digital Microwave at 1-2, Endgate at 1, Ericsson at 1, INNOVA at 3, NSMA at 1, SBE at 1, TIA at 2, and 360° Communications at 1. Andrew states that the proposed rules would cause harmful interference to co-channel users unless we also adopt rules requiring elevation limitations. We are adopting such elevation limitations. *See* ¶ 12.

[12] *See* Comsearch Comments at 2.

action would provide manufacturers with the flexibility to develop antennas with specific performance properties that are appropriate for the application, rather than performance limited by pre-existing regulations.[13]

7. We agree with Comsearch that spectrum efficiency is dependent upon antenna radiation pattern performance, that is, the beamwidth, sidelobe suppression, and the front-to-back ratio, and not upon antenna gain *per se*. Thus, we find that a showing of maximum beamwidth as an alternative to a minimum antenna gain showing can be permitted with no impact on spectrum efficiency. Moreover, we believe that such a change would serve the public interest because it allows a greater choice of technologies for licensees. Accordingly, we amend Sections 74.536, 74.641, 78.105, and 101.115 of the Commission's Rules to permit licensees to demonstrate compliance using either minimum gain or maximum beamwidth. The table below summarizes these amendments:

Minimum Gain	Maximum Beamwidth	Rule Section	Band (GHz)
34 dBi	3.5°	101.115(c)	10.55-10.68
36 dBi	2.7°	101.115(c)	3.7-4.2
38 dBi	2.2°	101.115(c)	5.925-6.425
			6.525-6.875
			10.55-10.68
			10.63-10.68
			10.7-11.7
			17.70-18.82
		74.536(c)	17.7-19.7
		74.641(a)(1)	17.7-19.7
		78.105(a)(1)	17.7-19.7
		101.115(c)	18.92-19.70
			21.2-23.6
			Above 31.3
		78.105(a)(1)	38.6-40.0

[13] *See* Endgate Comments at 2.

8. In the *NPRM*, we observed that even with the sidelobe suppression required by the existing rules, new types of antennas, such as planar array antennas, may differ somewhat from conventional dish and horn antennas in the exact shape of the mainlobe.[14] We stated that we do not believe that these differences in the shape of the mainlobe would have a significant impact on spectrum efficiency and, therefore, we proposed to treat all antennas as if they had the mainlobe shape and total gain of a conventional parabolic dish antenna.

9. Comsearch states that frequency coordinators perform interference calculations using actual antenna radiation pattern envelopes provided by the manufacturers. Comsearch notes that the Commission requires the radiation pattern information to be a part of the frequency coordination and license application process for fixed microwave services.[15] Comsearch states that using actual antenna radiation pattern data in frequency coordination maximizes spectrum efficiency by taking advantage of antenna performance exceeding artificial standards such as those described by Sections 74.536, 74.641, 78.105, and 101.115. Comsearch further states that the Commission should not promote the use of any assumptions, worst case or otherwise, about antenna performance, but instead should maintain the existing requirements that actual antenna radiation patterns be used for frequency coordination. With this procedure, Comsearch argues that any differences in the shape of the mainlobe of new antennas versus that of conventional antennas will be properly taken into account in interference calculations.

10. Likewise, Alcatel Network Systems, Inc. ("Alcatel") and the National Spectrum Managers Association ("NSMA") oppose the use of a "default" antenna pattern. Specifically, Alcatel requests that the sidelobe suppression specifications be maintained at their current level and the existing requirement that applicants provide antenna specific information, including radiation patterns where required, in prior coordination notices and applications.[16] Alcatel and NSMA urge the Commission not to deviate from the current rules, which require that applicants always provide proper reference to actual radiation pattern information in prior coordination notices and applications. Alcatel and NSMA asserts that these requirements should be maintained for all types of antennas proposed with respect to a given deployment. Alcatel further states that it is essential that frequency coordinators have actual antenna radiation mask data available to ensure accuracy in interference computations and to maximize spectral efficiency. Alcatel argues that, if prior coordination notices specify a "default" antenna pattern based on the antenna performance standards set forth in the Commission's Rules, less accurate computations and inefficient use of scarce spectrum would result.

11. Andrew Corporation ("Andrew") interprets the existing and proposed rules on beamwidth as limiting only the potential interference incident to a directional antenna's azimuth plane, while ignoring the significant potential for interference incident to the antenna's elevation

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[14] *See NPRM* at ¶ 8.

[15] *See* 47 C.F.R. §§ 101.21(d), 101.103(d).

[16] *See* Alcatel Comments at 2-3.

plane.[17] Andrew suggests that the Commission adopt rules to require specific limitations on the radiation power in both the azimuth and elevation planes of directional antennas in order to minimize the antenna's interference potential. Andrew states the adoption of rules that take into account the radiation of power in both the azimuth and elevation planes would better achieve the Commission's goal of encouraging the development and use of new antenna technology, minimize the risk of harmful interference, and ensure that antenna manufacturers continue to provide quality directional antennas. Andrew states that the Commission could achieve this change by simply noting in Sections 74.536, 74.641, 78.105, and 101.115 of the Rules that the beamwidth limitations and radiation suppression limitations set forth therein apply to both the azimuth and the elevation planes.

12. We agree with Alcatel, Comsearch, and NSMA that the present requirement that fixed microwave applicants under Part 101 provide antenna measurement data for coordination should be retained without modification because the use of actual patterns will maximize spectrum efficiency.[18] We also agree with Andrew that compliance with the maximum beamwidth requirements should be met in both the azimuth and elevation planes. Accordingly, we are amending the antenna standards tables in Parts 74, 78, and 101 by adding a footnote, which states that if a licensee chooses to show compliance using maximum beamwidth to 3 dB points, the beamwidth limit shall apply in both the azimuth and the elevation planes.[19] However, we decline to change the radiation suppression limitations and to apply this requirement to antennas that show compliance with the existing minimum gain requirement because these issues are outside the scope of this proceeding. We stated clearly in the *NPRM* that we did not intend to modify requirements for existing antennas that met our minimum gain requirements. Moreover, no change to our rules is required in such circumstances.

C. Other Issues

13. Endgate's Proposal. Several parties raise additional issues in their comments. Specifically, Endgate states that our proposal to allow compliance to be shown using either

[17] Azimuth or bearing is the angular position in a horizontal plane, expressed as the angle in degrees from true north in a clockwise direction. Elevation is the angle between the horizon and a target in the same vertical plane.

[18] Each application in the Private Operational Fixed Point-to-Point Microwave, Common Carrier Fixed Point-to-Point Microwave, Local Television Transmission, and Digital Electronic Message Services (excluding user stations) proposing a new or replacement antenna (excluding omnidirectional antennas) must include an antenna radiation pattern showing the antenna gain distribution in the horizontal plane expressed in decibels, unless such pattern is known to be on file with the Commission in which cases the applicant may reference in its application the FCC-ID number that indicates that the pattern is on file with the Commission. *See* 47 C.F.R. § 101.21(d).

[19] In addition, we take this opportunity to correct an error in Section 101.115. Specifically, we delete the reference to old footnote 7 (re-numbered in this *Report and Order* as footnote 8) in the 10.565-10.615 GHz band, which is reserved for nodal stations in the Digital Electronic Message Service that are expected to employ omnidirectional or widebeam antennas.

minimum antenna gain or maximum beamwidth is insufficient.[20] Endgate believes that the existing requirements that specify the maximum transmitter power and the relative sidelobe radiation suppression values inappropriately restrict the types of antennas which can be used for certain applications such as short distance, low power "Campus Local Area Networks," "Local Video Conferencing," and Local Multipoint Distribution Services. Endgate therefore proposes that the Commission further modify the existing rules to adopt a maximum EIRP radiated power envelope in place of the maximum input power and relative sidelobe radiation suppression values. Endgate argues that its proposal preserves the intent of the rules to minimize interference, and further maximizes spectrum efficiency without precluding the use of lower gain, low power antennas that are appropriate for emerging technologies. Endgate also states that its proposed rule change would permit antennas that have aesthetic advantages by virtue of their relatively small size and/or low profile.

14. Both Comsearch and NSMA oppose Endgate's proposal in their reply comments. Specifically, Comsearch points out that Endgate's proposal would enable existing systems operating below maximum EIRP to increase off main beam radiation and still meet the proposed EIRP envelope requirements.[21] Further, Comsearch states that since most terrestrial microwave systems are licensed below the maximum EIRP limits, this proposal would increase the amount of allowed radiated power at angles off the main beam which increases interference potential and constrains frequency reuse for terrestrial systems. NSMA raises similar concerns.[22]

15. We decline to adopt the rule change suggested by Endgate. We find that the risk of decreased spectrum efficiency outweighs the benefits of such a rule change. In future proceedings we may examine the question of whether any antenna regulation is needed in bands where licenses are granted on a wide-area basis.

16. SBE's Proposal. The Society of Broadcast Engineers ("SBE") requests that the Commission apply the proposed flexible minimum antenna standards to receiving antennas as well as transmitting antennas. SBE states that a receiving antenna with an unnecessarily broad radiation pattern envelope can have just as great a preclusive effect on spectrum efficiency as a transmitting antenna with an overly broad pattern.

17. We observe that under the aural broadcasting auxiliary stations and fixed microwave services rules, the new flexible minimum antenna standards apply to both transmitting and receiving antennas.[23] However, under the television broadcast auxiliary stations and cable television relay service rules, the choice of receiving antennas is left to the discretion of the

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[20] *See* Endgate Comments at 1-3.

[21] *See* Comsearch Reply Comments at 1.

[22] *See* NSMA Reply Comments at 2-3.

[23] *See* 47 C.F.R. §§ 74.536(b), 101.115(c) (1995).

licensee. Further, the licensee is not protected from interference that results from the use of antennas with poorer performance than identified in the pertinent antenna standards table.[24] We will not consider SBE's request in this proceeding. The *NPRM* addressed explicitly the alternative minimum gain requirement only. Accordingly, we dismiss SBE's request without prejudice. Nonetheless, we encourage any party desirous of requiring that receive antennas used by television broadcast auxiliary stations and/or in the cable television relay service meet the pertinent antenna standards to file a petition for rulemaking. In addition, SBE requests that the Commission issue an updated list of "frequency congested areas" in which Category A antennas would be required. However, SBE submitted no data indicating which areas should be so designated. Since we have no record on which to base a decision, we decline to act at this time.

18. Band Specific Proposals. Alcatel proposes that the new antenna standards for the 10.55-10.68 GHz band, scheduled to be effective on June 1, 1997, be relaxed to allowed continued use of two-foot diameter antennas after 1997 as opposed to the four-foot antennas required by Section 101.115(c), footnote 5.[25] Alcatel states that many Personal Communications Service ("PCS") providers have plans to use the 10.55-10.68 GHz band for cell site interconnections in urban areas. Alcatel states that these PCS providers want to use small antennas to reduce the physical loading on antenna structures and to minimize the visual appearance of the antennas. It argues that the path lengths are short and the higher gain of a four-foot antenna is not required to meet path reliability requirements. In order to accommodate these PCS user needs, Alcatel recommends that two-foot antennas be permitted under Category B and that two-and-a-half-foot antennas be permitted under Category A. Alcatel was supported in reply comments by the Fixed Point-to-Point Communications Section, Network Equipment Division of the Telecommunications Industry Association.[26] Similarly, INNOVA Corporation ("INNOVA") proposed that requirements for 37-40 GHz antennas be relaxed. We find that these two proposals are outside the scope of this proceeding and that there is insufficient record to adopt them at this time.[27]

CONCLUSION

19. By this action, we amend our fixed service microwave rules to make them more compatible with certain emerging technologies for directional antennas. Specifically, we will permit alternative showings that antennas comply with maximum beamwidth requirements rather than requirements for minimum antenna gains. We believe that this action will preserve the

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[24] *See* 47 C.F.R. §§ 74.641(a)(3), 78.105(a)(3) (1995).

[25] *See* Alcatel Comments at 3-4.

[26] *See* TIA Reply Comments at 3-4.

[27] In addition, Commco urges us to ensure that any technical rules adopted in this proceeding are consistent with the rules adopted in the 39 GHz proceeding.

intent of the rules to maximize spectrum efficiency and minimize interference. At the same time, such changes will provide Commission licensees with additional flexibility to use directional antennas employing emerging technologies for which, in contrast to conventional antennas, maximum antenna beamwidth is not correlated directly with minimum antenna gain. Finally, we believe that the amendment of our rules promotes the national policy goals set forth in Section 257 of the Communications Act by enabling entrepreneurs and other small businesses to market new and innovative antenna technology to providers of telecommunications services and information services.

ORDERING CLAUSE

20. Accordingly, IT IS ORDERED that Parts 74, 78 and 101 of the Commission's Rules, ARE AMENDED as specified in the Appendix, effective 30 days upon publication in the Federal Register. Authority for issuance of this *Report and Order* is taken pursuant to Sections 4(i), 302, 303(e), 303(f), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154(i), 302, 303(e), 303(f), and 303(r).

FINAL REGULATORY FLEXIBILITY ANALYSIS

21. As required by Section 603 of the Regulatory Flexibility Act, 5 U.S.C. § 603 ("RFA"), an Initial Regulatory Flexibility Analysis ("IRFA") was incorporated into the *NPRM* in this proceeding. The Commission sought written public comments on the proposals in the *NPRM*, including the IRFA. The Commission's Final Regulatory Flexibility Analysis ("FRFA") in this *Report and Order* conforms to the RFA, as amended by the Contract With America Advancement Act of 1996 ("CWAAA"), Pub. L. No. 104-121, 110 Stat. 847 (1996).[28]

Need for and Objectives of the Rules

22. The rule amendments are needed in order to allow licensees to make an alternative showing of compliance with the Commission's Rules for antenna standards. The objective of the rule amendments is to permit the use of new antenna technologies.

Summary of Significant Issues Raised by the Public Comments in Response to the IRFA

23. No comments were submitted in direct response to the IRFA. Nonetheless, we have considered the significant economic impact of the proposals on small entities.

[28] Subtitle II of the CWAAA is "The Small Business Regulatory Enforcement Fairness Act of 1996" ("SBREFA"), codified at 5 U.S.C. § 601 *et seq.*

Description and Estimate of the Number of Small Entities to Which Rule Will Apply

24. The RFA generally defines the term "small business" as having the same meaning as the term "small business concern" under the Small Business Act, 15 U.S.C. §632. Based on the statutory provision, we will consider a small business concern one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the Small Business Administration ("SBA"). The RFA SBREFA provisions also apply to nonprofit organizations and to governmental organizations.

25. These rule amendments pertain to licensees providing point-to-point microwave services. The Commission has not developed a definition of small entities applicable to these services. Therefore, we will utilize the SBA definition applicable to radiotelephone companies. This definition provides that a small entity is a radiotelephone company employing fewer than 1,500 persons.[29] Census Bureau data indicates that there are 1,164 radiotelephone companies with fewer than 1,500 employees, that might qualify as small entities if they are independently owned are operated.[30] Since the Regulatory Flexibility Act amendments were not in effect until the record in this proceeding was closed, the Commission was unable to request information regarding the number of small businesses that would be affected by this action. It is unknown how many small entities may be affected. We believe that all entities affected by the rule amendments will benefit from this action which allows licensees more flexibility in making a showing that their antennas meet minimum antenna performance standards.

Description of Projected Reporting, Recordkeeping and Other Compliance Requirements

26. No new requirements are involved. Licensees will be afforded the option of complying with a standard for maximum antenna beamwidth as an alternative to complying with the existing requirement for minimum antenna gain. Thus, the types of professional skills necessary to comply with the rule amendments already exist within the effected companies.

Significant Alternatives and Steps Taken by Agency to Minimize Significant Economic Impact on a Substantial Number of Small Entities Consistent with Stated Objectives

27. We have considered and rejected several significant alternatives. The *NPRM* raised the question of whether new types of antennas should be presumed to be conventional for coordination purposes. All the commenting parties opposed such a change and stated that the present requirement that licensees provide antenna measurement data for coordination should be retained. We agree and are keeping all such existing requirements without modification. In comments Endgate Corporation proposes that the Commission adopt a maximum radiated power envelope in place of the existing rules which specify both the maximum transmitter power and

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[29] 13 C.F.R. § 121.201, Standard Industrial Classification (SIC) Code 4812.

[30] U.S. Dept. of Commerce, *1992 Census of Transportation, Communications and Utilities: Establishment and Firm Size 10123 (May 1995).*

the relative sidelobe radiation suppression values. This would allow wide antenna beams and higher sidelobe levels for licensees that use less than the maximum radiated power. Both Comsearch and NSMA oppose Endgate's proposal in reply comments. Comsearch points out that since most terrestrial microwave systems are licensed below the maximum EIRP limits, this proposal would increase the amount of allowed radiated power at angles off the main beam which increases interference potential and constrains frequency reuse for terrestrial systems. NSMA raised similar concerns. Thus we decline to make this change as suggested by Endgate as we find that the risk of decreased spectrum efficiency outweighs the benefits for microwave licensees, including small entities.

28. Andrew interprets the existing and proposed rules on beamwidth to limit only horizontal beamwidth and asks that the rules clearly state that both horizontal and vertical beamwidth and radiation suppression be limited. We agree that for antennas to show compliance with requirements by meeting a maximum beamwidth that beamwidth must apply in both planes. However, we decline to apply this requirement to antennas that show compliance with the existing minimum gain requirement. If a high gain requirement is met by the antenna, physical principals limit the amount of trade off between vertical and horizontal beamwidth that is possible. Also, we clearly stated in the *NPRM* that we did not intend to modify requirements for existing antennas which met our minimum gain requirement.

29. SBE requests that the Commission apply the proposed flexible minimum antenna standards to receiving antennas as well as to transmitting antennas. Since the *NPRM* addressed explicitly the alternative minimum gain requirement only, we will not consider SBE's request in this proceeding. SBE also requests that the Commission issue an updated list of "frequency congested areas" in which Category A antennas would be required. However, SBE submitted no data indicating which areas should be so designated. Since we have no record to base a decision on, we decline to act at this time.

30. Alcatel proposes that antenna standards for the 10 GHz band be relaxed to allowed continued use of 2 foot antennas after 1997 as opposed to the 4 foot antennas required by present rules. Alcatel was supported in reply comments by TIA. Similarly, INNOVA proposes that requirements for 37-40 GHz antennas be relaxed. These two proposals were outside the scope of the original notice and we feel that there is insufficient record to adopt them at this time.

31. **Report to Congress:** The Commission shall send a copy of this Final Regulatory Flexibility Analysis, along with this Report and Order, in a report to Congress pursuant to the Small Business Regulatory Enforcement Fairness Act of 1996, 5 U.S.C. § 801 (a)(1)(A). A copy of this FRFA will also be published in the Federal Register.

FEDERAL COMMUNICATIONS COMMISSION

William F. Caton
Acting Secretary

Appendix: Final Rules

Parts 74, 78, and 101 of the Code of Federal Regulations are amended as follows:

PART 74 -- EXPERIMENTAL RADIO, AUXILIARY, SPECIAL BROADCAST AND OTHER PROGRAM DISTRIBUTIONAL SERVICES

1. The authority citation for Part 74 continues to read as follows:

AUTHORITY: Secs. 4, 303, 48 Stat. 1066, as amended, 1082, as amended; 47 U.S.C. 154, 303, 554.

2. In Section 74.536, paragraphs (b) and (c) are revised to read as follows:

§ 74.536 Directional antenna required.

* * * * *

(b) An aural broadcast STL or intercity relay station operating in the 17.7-19.7 GHz band shall employ an antenna that meets the performance standards for Category A, except that in areas not subject to frequency congestion, antennas meeting standards for Category B may be employed. However, the Commission may require the replacement, at the licensee's expense, of any antenna or periscope antenna system of a permanent fixed station that does not meet performance Standard A, which is specified in the table in paragraph (c), upon a showing that said antenna causes or is likely to cause interference to (or receive interference from) any other authorized or proposed station; provided that an antenna meeting performance Standard A is unlikely to involve such interference.

(c) Licensees shall comply with the antenna standards table shown in this paragraph in the following manner:

(1) With either the maximum beamwidth to 3 dB points requirement or with the minimum antenna gain requirement; and

(2) With the minimum radiation suppression to angle requirement.

Antenna Standards

Frequency (GHz)	Category	Maximum beamwidth to 3 dB points[1] (included angle in degrees)	Minimum antenna gain (dbi)	Minimum radiation suppression to angle in degrees from centerline of main beam in decibels						
				5° to 10°	10° to 15°	15° to 20°	20° to 30°	30° to 100°	100° to 140°	140° to 180°
17.7 to 19.7...	A	2.2	38	25	29	33	36	42	55	55
	B	2.2	38	20	24	28	32	35	36	36
31.0 to 31.3[2]	n/a	[3]4.0	38	n/a	n/a	n/a	n/a	n/a	n/a	n/a

[1] If a licensee chooses to show compliance using maximum beamwidth to 3 dB points, the beamwidth limit shall apply in both the azimuth and the elevation planes.

[2] Mobile, except aeronautical mobile, stations need not comply with these standards.

[3] The minimum front-to-back ratio shall be 38 dBi.

3. In Section 74.641, paragraph (a)(1) is revised to read as follows:

§ 74.641 Antenna systems.

(a) * * *

(1) Fixed TV broadcast auxiliary stations shall use directional antennas that meet the performance standards indicated in the following table. Upon adequate showing of need to serve a larger sector, or more than a single sector, greater beamwidth or multiple antennas may be authorized. Applicants shall request, and authorization for stations in this service will specify, the polarization of each transmitted signal. Booster station antennas having narrower beamwidths and reduced sidelobe radiation may be required in congested areas, or to resolve interference problems. Licensees shall comply with the antenna standards table shown in this paragraph in the following manner:

(i) With either the maximum beamwidth to 3 dB points requirement or with the minimum antenna gain requirement; and

(ii) With the minimum radiation suppression to angle requirement.

Antenna Standards

Frequency (MHz)	Category	Maximum beamwidth to 3 dB points[1] (included angle in degrees)	Minimum antenna gain (dbi)	Minimum radiation suppression to angle in degrees from centerline of main beam in decibels						
				5° to 10°	10° to 15°	15° to 20°	20° to 30°	30° to 100°	100° to 140°	140° to 180°
1,990 to 2,110	A	5.0	n/a	12	18	22	25	29	33	39
	B	8.0	n/a	5	18	20	20	25	28	36
6,875 to 7,125	A	1.5	n/a	26	29	32	34	38	41	49
	B	2.0	n/a	21	25	29	32	35	39	45
12,700 to 13,250.....	A	1.0	n/a	23	28	35	39	41	42	50
	B	2.0	n/a	20	25	28	30	32	37	47
17,700 to 19,700.....	A	2.2	38	25	29	33	36	42	55	55
	B	2.2	38	20	24	28	32	35	36	36
31,000 to 31,300[2].....	n/a	[3]4.0	38	n/a	n/a	n/a	n/a	n/a	n/a	n/a

[1] If a licensee chooses to show compliance using maximum beamwidth to 3 dB points, the beamwidth limit shall apply in both the azimuth and the elevation planes.

[2] Mobile, except aeronautical mobile, stations need not comply with these standards.

[3] The minimum front-to-back ratio shall be 38 dBi.

NOTE: Stations must employ an antenna that meets the performance standards for Category B. In areas subject to frequency congestion, where proposed facilities would be precluded by continued use of a Category B antenna, a Category A antenna must be employed. The Commission may require the use of a high performance antenna where interference problems can be resolved by the use of such antennas.

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PART 78 -- CABLE TELEVISION RELAY SERVICE

1. The authority citation for Part 78 continues to read as follows:

AUTHORITY: Secs. 2, 3, 4, 301, 303, 307, 308, 309, 48 Stat., as amended, 1064, 1065, 1066, 1081, 1082, 1083, 1084, 1085; 47 U.S.C. 152, 153, 154, 301, 303, 307, 308, 309.

2. In Section 78.105, paragraph (a)(1) is revised to read as follows:

§ 78.105 Antenna systems.

(a) * * *

(1) Fixed CARS stations shall use directional antennas that meet the performance standards indicated in the following table.

(i) Stations must employ an antenna that meets the performance standards for Category B. In areas subject to frequency congestion, where proposed facilities would be precluded by continued use of a Category B antenna, a Category A antenna must be employed. The Commission may require the use of a high performance antenna where interference problems can be resolved by the use of such antennas.

(ii) Upon adequate showing of need to serve a larger sector, or more than a single sector, greater beamwidth or multiple antennas may be authorized. Applicants shall request and authorization for stations in this service will specify the polarization of each transmitted signal.

(iii) Licensees shall comply with the antenna standards table shown in this paragraph in the following manner:

(A) With either the maximum beamwidth to 3 dB points requirement or with the minimum antenna gain requirement; and

(B) With the minimum radiation suppression to angle requirement.

Antenna Standards

Frequency (MHz)	Category	Maximum beamwidth to 3 dB points[1] (included angle in degrees)	Minimum antenna gain (dbi)	Minimum radiation suppression to angle in degrees from centerline of main beam in decibels						
				5° to 10°	10° to 15°	15° to 20°	20° to 30°	30° to 100°	100° to 140°	140° to 180°
12,700 to 13,250.....	A	1.0	n/a	23	28	35	39	41	42	50
	B	2.0	n/a	20	25	28	30	32	37	47
17,700 to 19,700.....	A	2.2	38	25	29	33	36	42	55	55
	B	2.2	38	20	24	28	32	35	36	36
31,000 to 31,300[2].....	n/a	[3]4.0	38	n/a	n/a	n/a	n/a	n/a	n/a	n/a
38,600 to 40,000.....	A	2.2	38	25	29	33	36	42	55	55
	B	2.2	38	20	24	28	32	35	36	36

[1] If a licensee chooses to show compliance using maximum beamwidth to 3 dB points, the beamwidth limit shall apply in both the azimuth and the elevation planes.

[2] Mobile, except aeronautical mobile, stations need not comply with these standards.

[3] The minimum front-to-back ratio shall be 38 dBi.

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PART 101 -- FIXED MICROWAVE SERVICES

1. The authority citation for Part 101 continues to read as follows:

AUTHORITY: 47 U.S.C. §§ 154(i), 303, unless otherwise noted.

2. In Section 101.115, paragraph (c) is revised to read as follows:

§101.115 Directional antennas.

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(c) Fixed stations (other than temporary fixed stations and DEMS nodal stations) operating at 932.5 MHz or higher must employ transmitting and receiving antennas (excluding second receiving antennas for operations such as space diversity) meeting the appropriate performance Standard A indicated below, except that in areas not subject to frequency congestion, antennas meeting performance Standard B may be used, subject to the requirements set forth in paragraph (d) of this section. Licensees shall comply with the antenna standards table shown in this paragraph in the following manner:

(i) With either the maximum beamwidth to 3 dB points requirement or with the minimum antenna gain requirement; and

(ii) With the minimum radiation suppression to angle requirement.

Antenna Standards

Frequency (MHz)	Category	Maximum beamwidth to 3 dB points[1] (included angle in degrees)	Minimum antenna gain (dbi)	Minimum radiation suppression to angle in degrees from centerline of main beam in decibels						
				5° to 10°*	10° to 15°*	15° to 20°*	20° to 30°*	30° to 100°*	100° to 140°*	140° to 180°*
932.5 to 935...	A	14.0	n/a	n/a	6	11	14	17	20	24
	B	20.0	n/a	n/a	n/a	6	10	13	15	20
941.5 to 944...	A	14.0	n/a	n/a	6	11	14	17	20	24
	B	20.0	n/a	n/a	n/a	6	10	13	15	20
952 to 960[2, 3]	A	14.0	n/a	n/a	6	11	14	17	20	24
	B	20.0	n/a	n/a	n/a	6	10	13	15	20
1,850 to 2,500[4].....	A	5.0	n/a	12	18	22	25	29	33	39
	B	8.0	n/a	5	18	20	20	25	28	36
3,700 to 4,200	A	2.7	36	23	29	33	36	42	55	55
	B	2.7	36	20	24	28	32	32	32	32
5,925 to 6,425[5].....	A	2.2	38	25	29	33	36	42	55	55
	B	2.2	38	21	25	29	32	35	39	45
5,925 to 6,425[6].....	A	2.2	38	25	29	33	36	42	55	55
	B	2.2	38	20	24	28	32	35	36	36

Antenna Standards

Frequency (MHz)	Category	Maximum beamwidth to 3 dB points[1] (included angle in degrees)	Minimum antenna gain (dbi)	Minimum radiation suppression to angle in degrees from centerline of main beam in decibels						
				5° to 10°*	10° to 15°*	15° to 20°*	20° to 30°*	30° to 100°*	100° to 140°*	140° to 180°*
6,525 to 6,875[5]	A	2.2	38	25	29	33	36	42	55	55
	B	2.2	38	21	25	29	32	35	39	45
6,525 to 6,875[6]	A	1.5	n/a	26	29	32	34	38	41	49
	B	2.0	n/a	21	25	29	32	35	39	45
10,550 to 10,680[5, 7]	A	2.2	38	25	29	33	36	42	55	55
	B	2.2	38	20	24	28	32	35	35	39
10,550 to 10,680[6]	A	3.4	34	20	24	28	32	35	55	55
	B	3.4	34	20	24	28	32	35	35	39
10,565 to 10,615	n/a	360	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
10,630 to 10,680[8]	n/a	3.5	34	20	24	28	32	35	36	36
10,700 to 11,700[5]	A	2.2	38	25	29	33	36	42	55	55
	B	2.2	38	20	24	28	32	35	36	36

Antenna Standards

Frequency (MHz)	Category	Maximum beamwidth to 3 dB points[1] (included angle in degrees)	Minimum antenna gain (dbi)	Minimum radiation suppression to angle in degrees from centerline of main beam in decibels						
				5° to 10°*	10° to 15°*	15° to 20°*	20° to 30°*	30° to 100°*	100° to 140°*	140° to 180°*
12,200 to 13,250[9].....	A	1.0	n/a	23	28	35	39	41	42	50
	B	2.0	n/a	20	25	28	30	32	37	47
17,700 to 18,820.....	A	2.2	38	25	29	33	36	42	55	55
	B	2.2	38	20	24	28	32	35	36	36
18,920 to 19,700[10].....	A	2.2	38	25	29	33	36	42	55	55
	B	2.2	38	20	24	28	32	35	36	36
21,200 to 23,600[11].....	A	2.2	38	25	29	33	36	42	55	55
	B	2.2	38	20	24	28	32	35	36	36
31,000 to 31,300[12, 13].....	n/a	4.0	38	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Above 31,300	A	2.2	38	25	29	33	36	42	55	55
	B	2.2	38	20	24	28	32	35	36	36

[1] If a licensee chooses to show compliance using maximum beamwidth to 3 dB points, the beamwidth limit shall apply in both the azimuth and the elevation planes.

[2] Except for Multiple Address System frequencies listed in paragraphs 101.147(b)(1) through 101.147(b)(4) of this part, where omnidirectional antennas may be used.

[3] Antennas used at outlying stations as part of a central protection alarm system need conform to only the following 2 standards: (i) The minimum on-beam forward gain must be at least 10 dBi, and (ii) the minimum front-to-back ratio must be at least 20 dB.

[4] Omnidirectional antennas may be authorized in the band 2150-2160 MHz.

[5] These antenna standards apply to all point-to-point stations authorized after June 1, 1997. Existing licensees and pending applicants on that date are grandfathered and need not comply with these standards.

[6] These antenna standards apply to all point-to-point stations authorized on or before June 1, 1997.

[7] Except for antennas between 140° and 180° authorized or pending on January 1, 1989, in the band 10,550 to 10,565 MHz for which minimum radiation suppression to angle (in degrees) from centerline of main beam is 36 decibels.

[8] These antenna standards apply only to DEMS User Stations licensed, in operation, or applied for prior to July 15, 1993.

[9] Except for temporary-fixed operations in the band 13200-13250 MHz with output powers less than 250 mW and as provided in § 101.147(q).

*[10] DEMS User Station antennas in this band must meet performance Standard B and have a minimum antenna gain of 34 dBi. The maximum beamwidth requirement does not apply to DEMS User Stations. DEMS Nodal Stations need not comply with these standards.

[11] Except as provided in § 101.147(t). **Note to footnote 11:** Stations must employ an antenna that meets the performance standards for Category A, except that in areas not subject to frequency congestion, antennas meeting standards for Category B may be employed. Note, however, that the Commission may require the use of high performance antennas where interference problems can be resolved by the use of such antennas.

[12] The minimum front-to-back ratio shall be 38 dBi.

[13] Mobile, except aeronautical mobile, stations need not comply with these standards